

# Ultra-Efficient Engine Technology Project Continued to Contribute to Breakthrough Technologies

The International Civil Aviation Organization (ICAO), the U.S. Environmental Protection Agency (EPA), local environmental groups, and the public have become increasingly concerned over damage to local air quality from aircraft emissions and the impact of producing greenhouse gases. The NASA Glenn Research Center has been working to develop revolutionary technologies to minimize environmentally harmful engine emissions, such as nitrogen oxides, carbon dioxide, aerosols, and particulates.

Beginning in fiscal year 2000, Glenn began the 6-year, \$300-million Ultra-Efficient Engine Technology (UEET) Program. In fiscal year 2003, the UEET Program became a project within the Vehicle Systems Program in NASA's Aerospace Technology Enterprise.

The two objectives of UEET are (1) to develop technologies to reduce nitrogen oxide (NO<sub>x</sub>) emissions by 70 percent below 1996 ICAO regulations and (2) to decrease carbon dioxide emissions (CO<sub>2</sub>) by dramatically increasing performance and efficiency. High-temperature engine materials, ultra-low-NO<sub>x</sub> combustor designs, efficient, highly loaded turbomachinery, and propulsion-airframe integration analysis are technologies being developed at Glenn to meet these goals. Technology developed in the previous Advanced Subsonic Technology Program is being put into commercial production for large and regional aircraft to reduce NO<sub>x</sub> emissions 50 percent below 1996 ICAO regulations for landing and takeoff cycles. UEET will take the technology to the next quantum leap—reducing emissions to 70 percent below the ICAO regulations level. In addition, NASA-developed research will significantly reduce carbon monoxide, unburned hydrocarbons, and corresponding cruise NO<sub>x</sub> levels for the next generation of aircraft engines.

Technologies are being developed for subsonic and supersonic commercial engine applications. In addition, key technologies from the UEET Program are critical to advanced engine technology programs within the Department of Defense, which relies on NASA technology in this area.

Glenn's UEET research will be useful across the whole range of flight: subsonic, supersonic, and hypersonic. It will improve the subsonic transportation that the public depends on, contribute to supersonic commercial aircraft, improve military aircraft, and contribute to the design of a future hypersonic vehicle. These technologies are contributing to a better quality of life on Earth.

The overall UEET project includes research efforts at Glenn, the NASA Langley Research Center, and the NASA Ames Research Center, as well as at the five U.S. gas turbine manufacturers (GE Aircraft Engines, Pratt & Whitney, Allison Advanced Development Corporation/Rolls-Royce, Honeywell, and Williams International), two major airframe companies (the Boeing Company and Lockheed Martin), and a number of universities and

small businesses.



*As NASA's turbine engine technology program, the vision of the Ultra-Efficient Engine Technology project is to develop and hand off revolutionary turbine engine propulsion technologies that will enable future generation vehicles over a wide range of flight speeds.*

**Glenn contacts:** Dr. Robert J. Shaw, 216-977-7135, [Robert.J.Shaw@nasa.gov](mailto:Robert.J.Shaw@nasa.gov); and Lori A. Manthey, 216-433-2484, [Lori.A.Manthey@nasa.gov](mailto:Lori.A.Manthey@nasa.gov)

**Author:** Dr. Robert J. Shaw, UEET project manager

**Headquarters program office:** OAT

**Programs/Projects:** Vehicle Systems, UEET